

*Riverwalk Downtown City Apartment Development*  
*Traffic Impact Report*  
*Rochester, MN*  
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## INTRODUCTION

The purpose of this report is to document the expected traffic impacts of the proposed Riverwalk Downtown City Apartment development between Civic Center Drive SE and 11<sup>th</sup> Avenue SE, north of East Center Street in Rochester, Minnesota.

The plan of the proposed development is shown in Figure 1. The proposed development will be a six story apartment building with 149 apartment units and underground parking. The goal of this traffic analysis is to determine the impact of the proposed development on the local roadway network, and specifically, the following intersections in the vicinity of the proposed development:

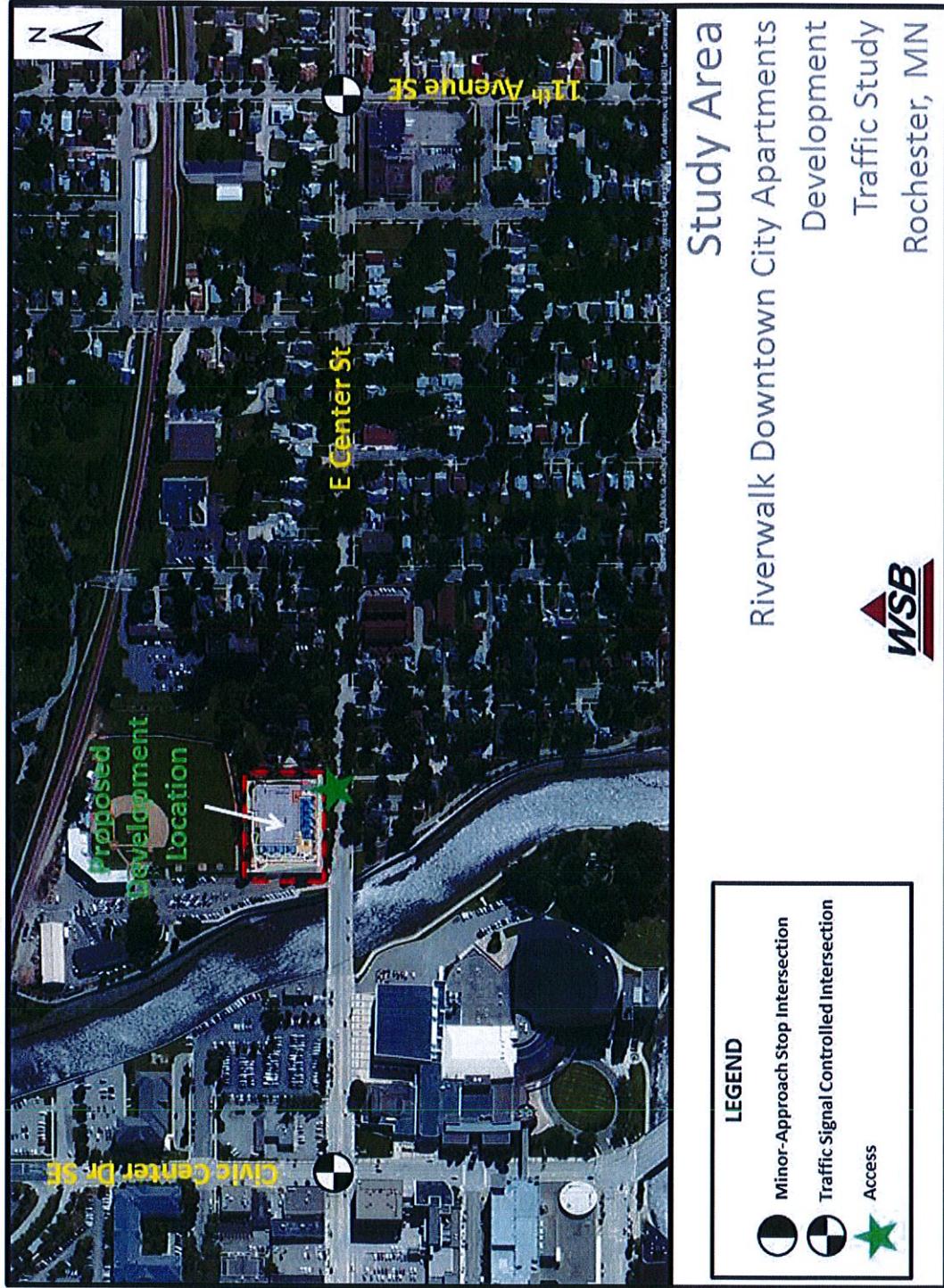
- Civic Center Drive SE and East Center Street
- 11<sup>th</sup> Avenue SE and East Center Street
- The apartment driveway and East Center Street

### **Proposed Development Characteristics**

The proposed project location is shown in Figure 1. The project will involve demolishing existing low density homes and constructing a six story apartment building in their place.

The development is proposed to be completed by fall of 2017. For the purpose of this study, traffic operations were evaluated for existing conditions, 2018 (1 year after opening) and for the horizon year 2028, 10 years later.

Figure 1: Study Area



## **EXISTING CONDITIONS**

The site for the proposed development is presently a residential neighborhood with low density housing. It is bounded on the west by Zumbro River and parking lot for Rochester Park and Forestry Maintenance Center, on the north by Mayo Field baseball arena, on the east by low density housing and on the south by East Center Street.

East Center Street in the vicinity of the project is a secondary urban arterial while Civic Center Drive SE and 11<sup>th</sup> Avenue SE are classified as major urban arterials in ROCOG 2040 Transportation Plan. The speed limit on all study roadways is 30 mph. East Center Street and 11<sup>th</sup> Avenue SE are two lane undivided roadways while Civic Center Drive SE is a four lane undivided roadway with center turning lanes. The lane configuration at the study intersections is shown in Figure 2.

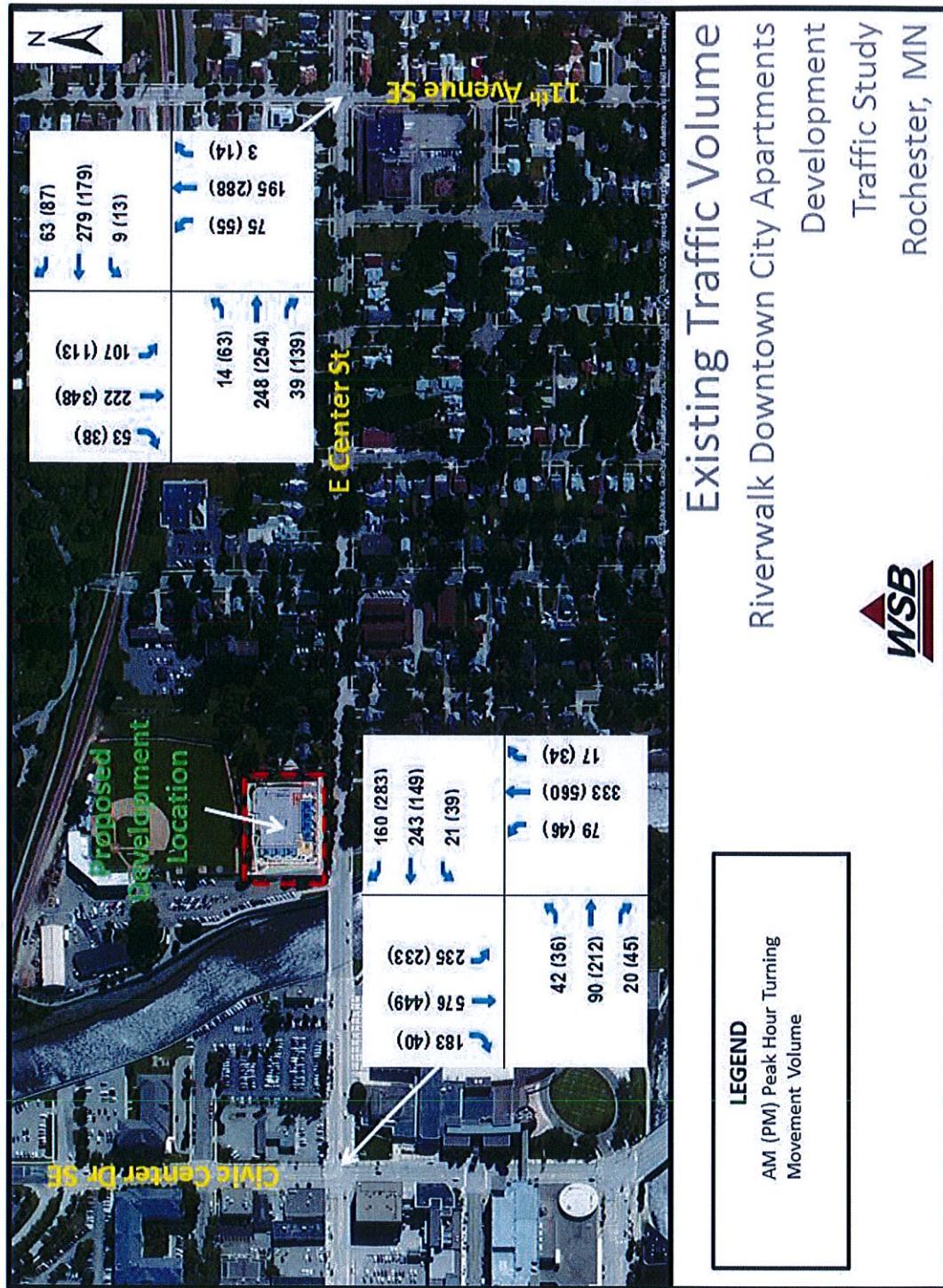
Turning movement counts were obtained for the existing intersections in September 2016. The peak hour traffic volumes for existing conditions for each intersection are shown in Figure 3. The count data are provided in the appendix. The existing and no-build conditions establish a baseline from which to compare future traffic operations with the addition of the proposed development.

Synchro/SimTraffic was used for the operational analysis of the study area intersections. The intersection operational analysis process includes determining the Level of Service (LOS) for the key intersections under the existing peak hour traffic conditions. Further explanation of Synchro/SimTraffic model and Level of Service can be found in Appendix A. The City of Rochester requires that Level of Service C or better shall be maintained on any arterial or higher order street and a Level of Service D or better on any other non-residential street. Individual movements within any intersection shall be maintained at or above a Level of Service E. The Tables below display the existing AM peak hour and PM peak hour intersection Level of Service and queuing results. These Measures of Effectiveness (MOEs) were obtained by running SimTraffic simulation for five iterations and averaging the results from these five runs. Due to the stochastic nature of the simulation model, there can be minor variations in the MOEs reported by the model between various runs.

Figure 2: Existing Intersection Configuration



**Figure 3: Existing Traffic Volumes**



**Table 1: Existing AM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement				LOS by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Left-Turn Appr				Average & Maximum Traffic Queueing (feet)			
				L	T	R	L	T	R	Delay	LOS	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue
1: Civic Center Drive & Center Street	Signalized	NB	16	17	9	B	B	A	16	B						NB	40	77	400	89	162						
		WB	19	23	10	B	C	B	18	B	16	B	18	B	10	WB	39	125	96	210		53	187	125			
		SB	14	14	12	B	B	B	14	B						SB	75	186	400	112	262						
	2: 11th Avenue & Center Street	EB	25	24	14	C	C	B	23	C						EB	31	97	150	56	122						
		NB	15	9	6	B	A	A	11	B						NB	34	91	100	56	138						
		WB	37	28	19	D	C	B	27	C	18	B	10	B	11	WB	69	100	154	292							
2: 11th Avenue & Center Street	Signalized	SB	13	10	7	B	B	A	10	B						SB	42	103	300	76	172						
		EB	38	22	20	D	C	C	22	C						EB	13	48	150	118	250						

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 2: Existing PM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement				LOS by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Left-Turn Appr				Average & Maximum Traffic Queueing (feet)			
				L	T	R	L	T	R	Delay	LOS	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue
1: Civic Center Drive & Center Street	Signalized	NB	13	19	14	B	B	B	18	B						NB	27	63	400	140	221						
		WB	25	30	12	C	C	B	19	B	18	B	12	B	27	92	125	84	167		81	172	125				
		SB	15	11	7	B	B	A	12	B						SB	72	142	400	72	146						
	2: 11th Avenue & Center Street	EB	25	31	21	C	C	C	29	C						EB	25	100	150	130	268						
		NB	22	11	9	C	B	A	13	B						NB	33	99	100	89	188						
		WB	43	26	16	D	C	B	24	C	18	B	14	B	11	WB	40	100	115	268							
2: 11th Avenue & Center Street	Signalized	SB	18	13	8	B	B	A	14	B						SB	51	117	300	119	249						
		EB	36	24	20	D	C	C	24	C						EB	56	249	150	142	323						

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

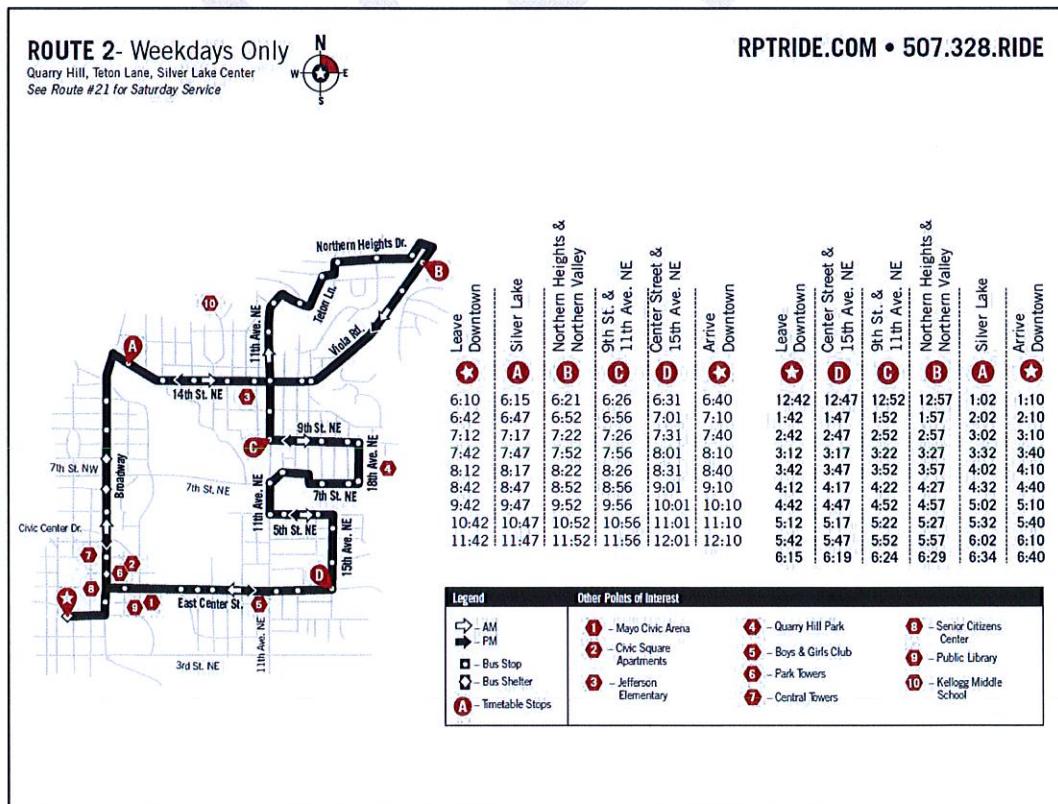
The intersections operate at a very good Level of Service B. The maximum through movement queues on East Center Street exceed the storage lengths of the turning lanes at the intersections in almost all cases in existing conditions. At the 11<sup>th</sup> Avenue SE and East Center Street intersection, the maximum through movement queue in northbound direction exceeds the left turn storage in both peak periods. However, the delays for turning vehicles at these approaches where the through queues exceed storage lengths are still low, indicating that significant mitigations may not be needed for this condition.

## Pedestrian Facilities and Transit Availability

East Center Street has a continuous sidewalk on both sides of the road separated by a curb, providing good pedestrian access to downtown to the west and to other uses to the east. There are no bike lanes along the corridor. Bikes are not allowed on sidewalks near downtown area in Rochester. On-street metered parking is available west of the proposed project side starting at the bridge on Zumbro River. These conditions could discourage use of bike mode in the study area.

East Center Street is currently served by bus route 2 during weekdays which provides service to downtown. The schedule for this route is shown below. The buses run every half hour in the peak periods. The stops for this bus service are within 400 feet of the driveway of the proposed apartment in both eastbound and westbound directions. There is also a weekend service available on bus route 21 which runs an eastbound loop from downtown.

**Figure 4: Transit Service Schedule**



Source: [www.rochestermn.gov](http://www.rochestermn.gov)

## TRAFFIC FORECASTS

Traffic for 2018 No-Build conditions was estimated assuming a compounded growth rates which were obtained from the regional travel demand model and discussions with Olmsted County planning division. The growth rate of traffic on East Center Street is 0.2%, on 11<sup>th</sup> Avenue SE is 0.38% and on Civic Center Drive SE is 0.92%. In estimating the trip generation for the proposed development, no reduction was taken for the existing residential units that will be removed. The estimated 2018 No-Build traffic volumes are shown in Figure 5.

Similar to the 2018 No-Build conditions, the background traffic was projected to 2028 for 2028 No-Build analysis. The estimated 2028 No-Build traffic volumes are shown in Figure 6.

The expected trip generation of the development is shown in Table 3 below. The development generated trips were estimated using trip generation rates from the ITE Trip Generation Manual 9<sup>th</sup> Edition.

**Table 3: Trip Generation**

Description	ITE Description/ITE Code	Expected Units	Daily Trips	AM Peak Trips	AM In	AM Out	PM Peak Trips	PM In	PM Out
Apartment with 149 units	Apartment/ 220	149	1027	77	15	62	100	65	35
Other Modes (10%)			(103)	(8)	(2)	(6)	(10)	(7)	(4)
<b>Net Trips</b>			<b>924</b>	<b>69</b>	<b>13</b>	<b>56</b>	<b>90</b>	<b>58</b>	<b>31</b>

Based on discussions with Olmsted County planning division, it is anticipated that 10% of the trips generated by the apartment use will walk, use transit, or other modes. WRONG

The trips were distributed to the roadway network using the trip distribution assumptions shown in Figure 7 which were developed based on guidance from Olmsted County planning division. The estimated development generated new trips are shown in Figure 8. The development generated trips were added to the 2018 No-Build traffic volumes to estimate the 2018 Build traffic volumes which are shown in Figure 9. The development generated trips were added to the 2028 No-Build traffic volumes to estimate the 2028 Build traffic volumes which are shown in Figure 10. The estimated average daily traffic values on the area streets under all scenarios are shown in Figure 11. The maximum impact to the existing intersections due to the development will occur on the eastbound and westbound through movements on East Center Street at the intersection of Civic Center Drive SE where fewer than thirty vehicles will be added to these movements in the peak hours. The impact to all remaining movements is less than ten vehicles during the peak hours.

Figure 5: No-Build 2018 Traffic Volumes

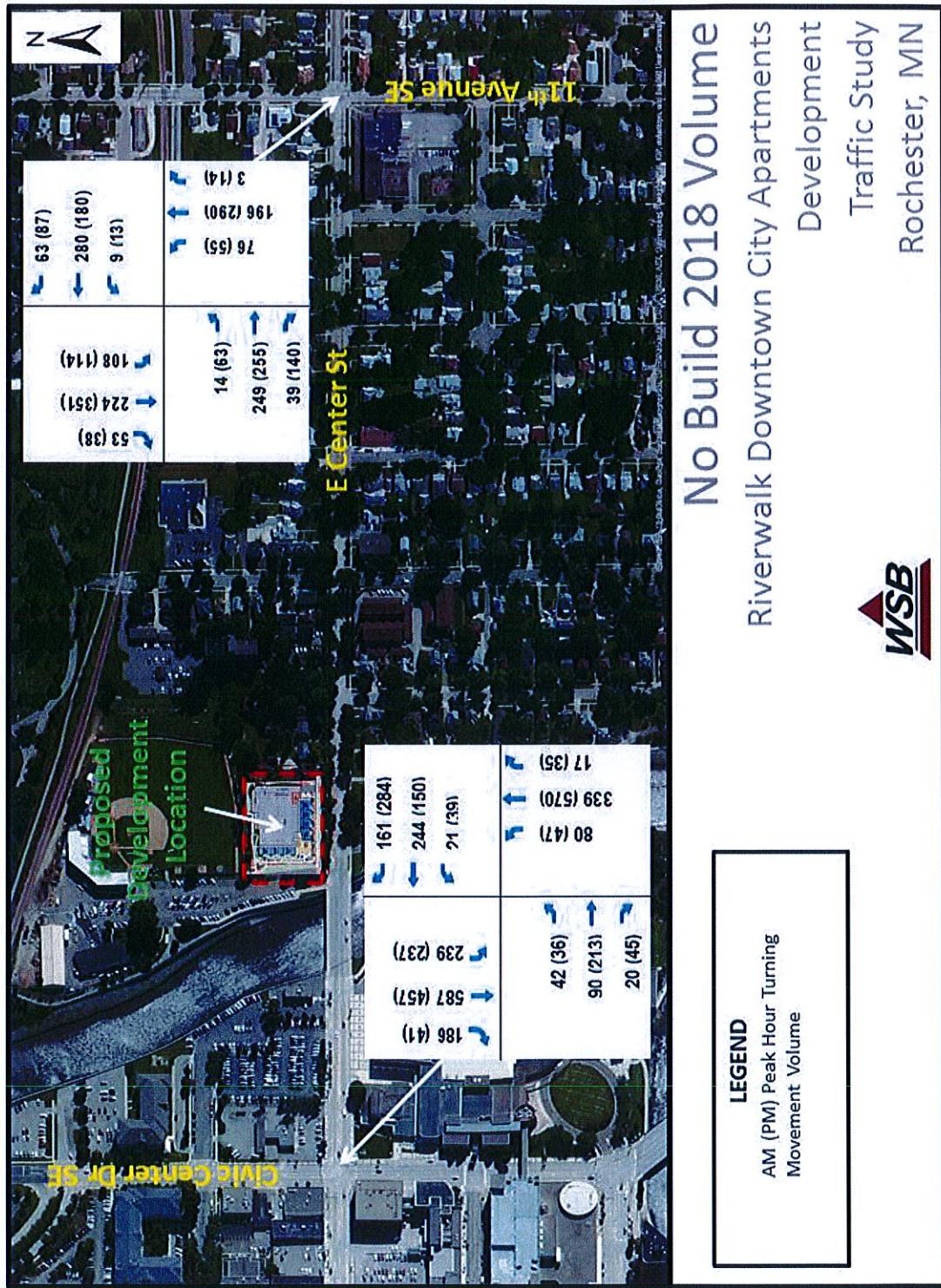
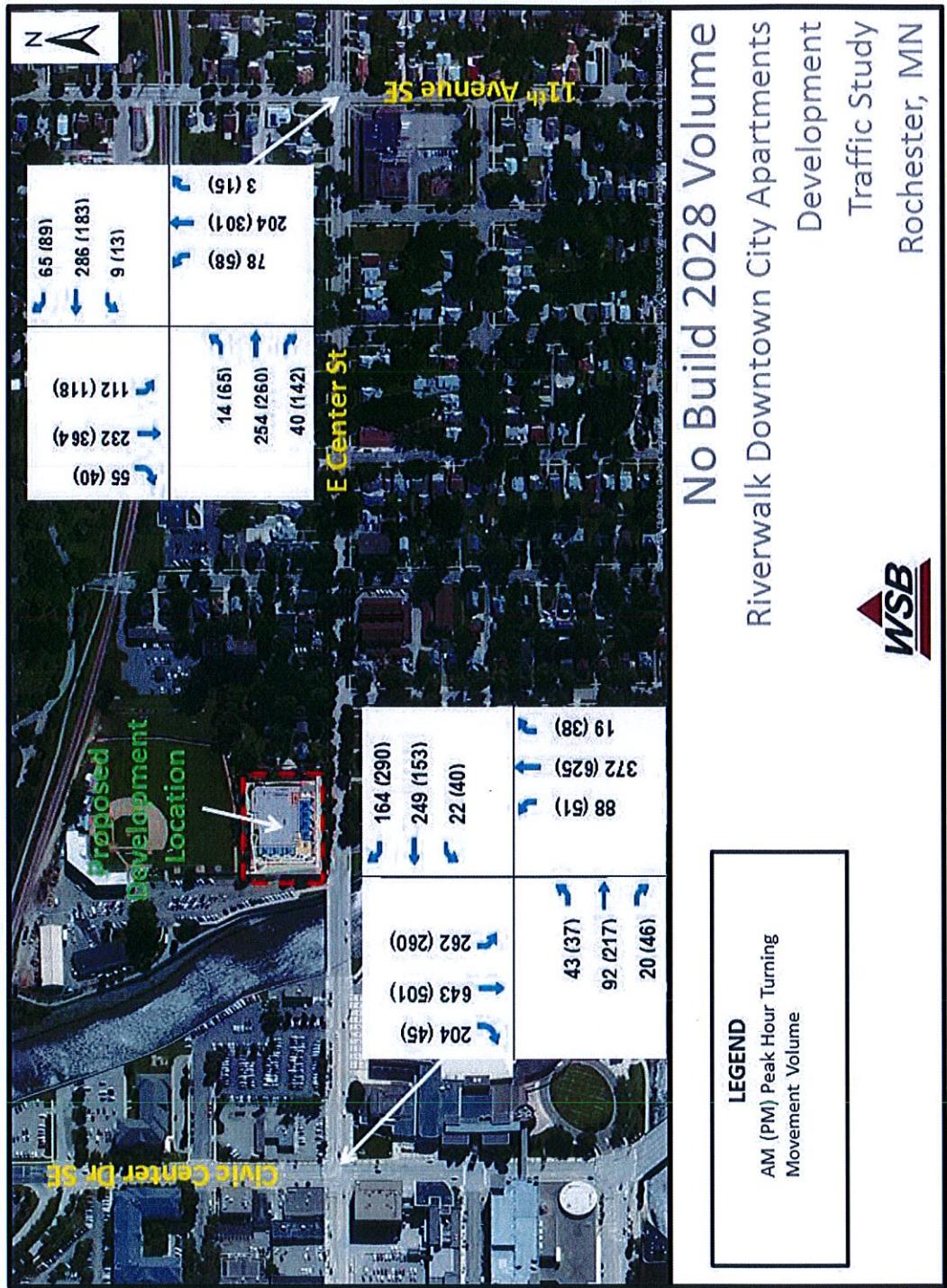


Figure 6: No-Build 2028 Traffic Volumes



**Figure 7: Trip Distribution**



Figure 8: Estimated Development Generated New Peak Hour Trips

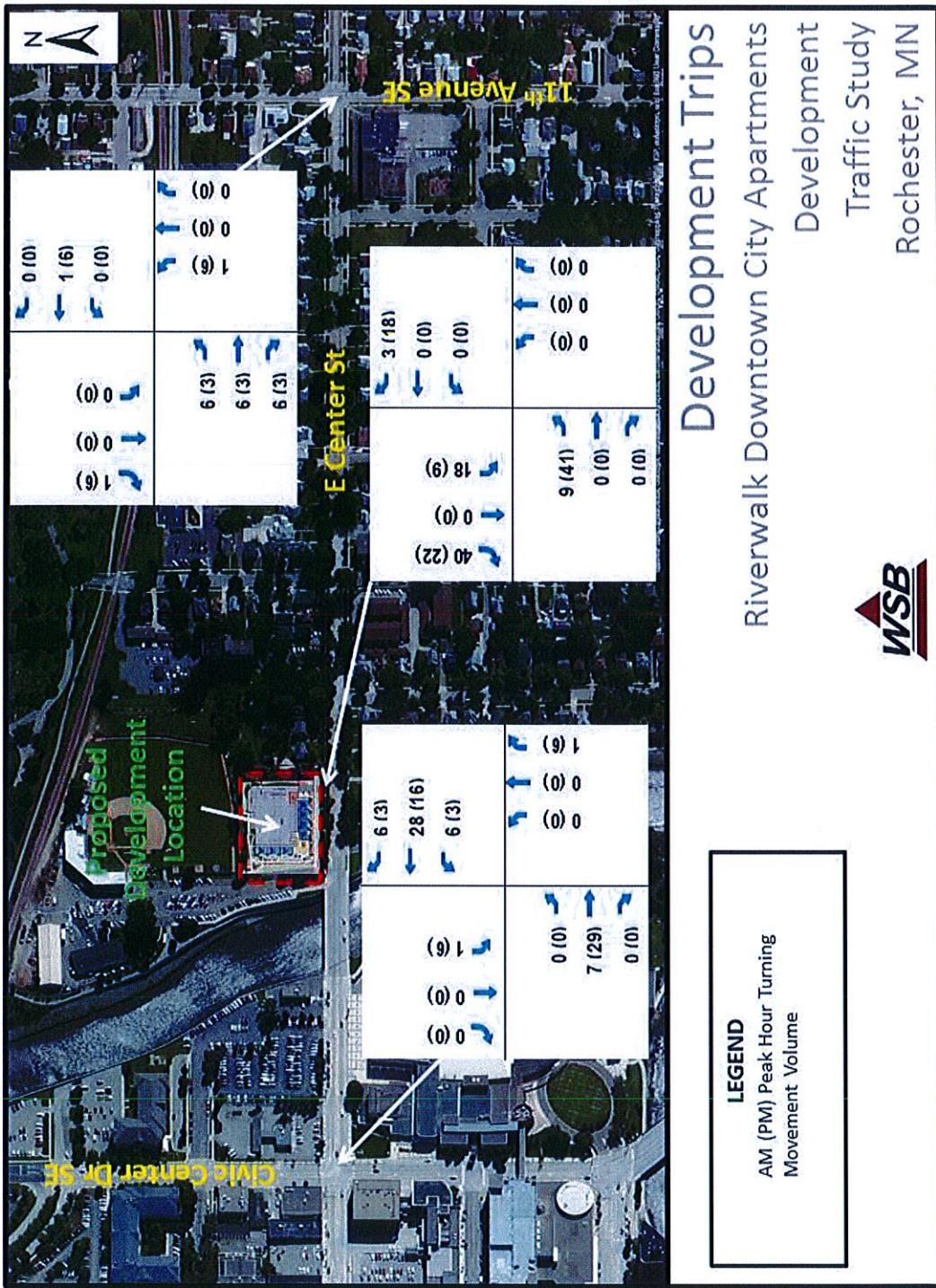


Figure 9: Build 2018 Traffic Volumes

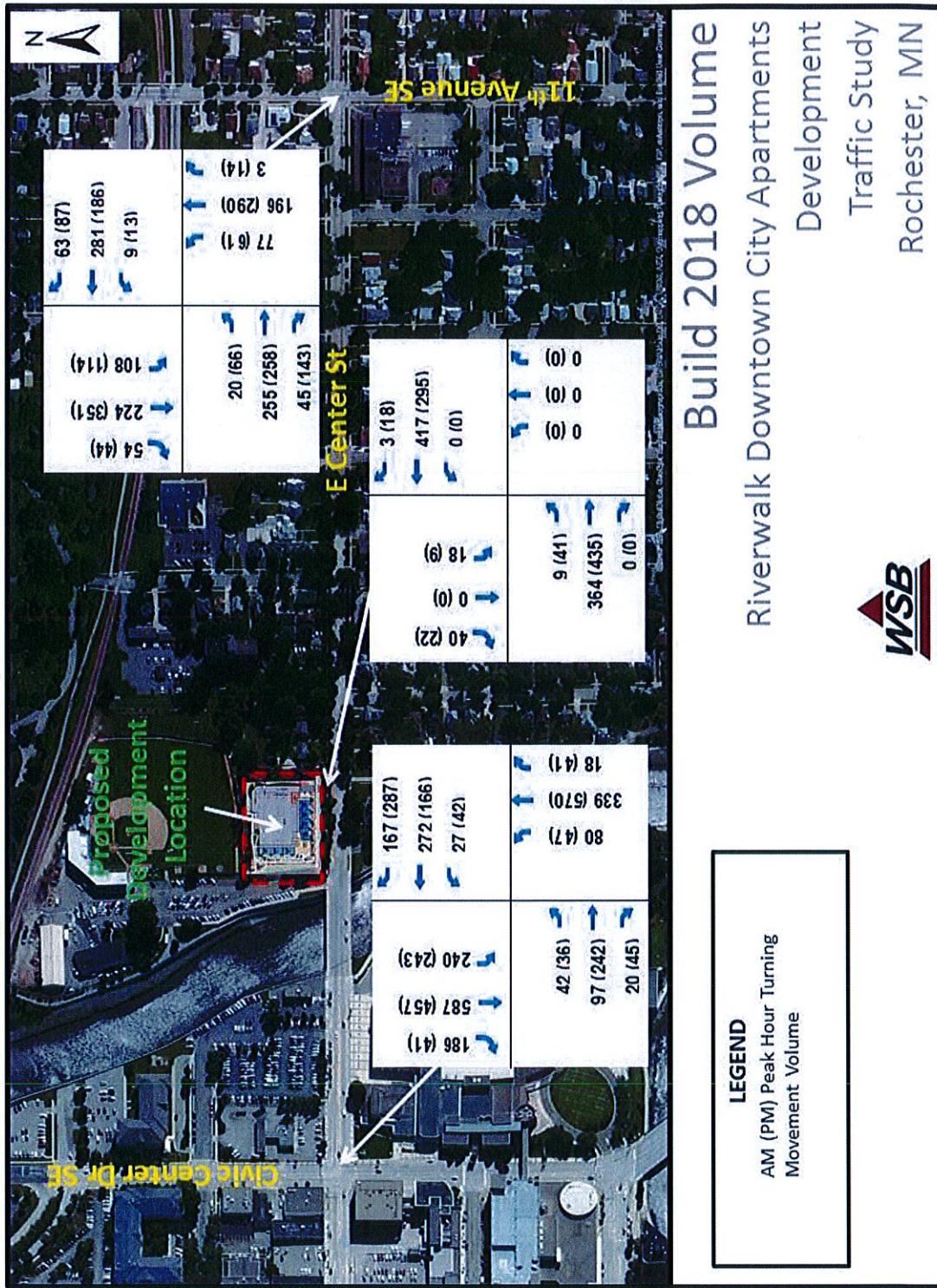


Figure 10: Build 2028 Traffic Volumes

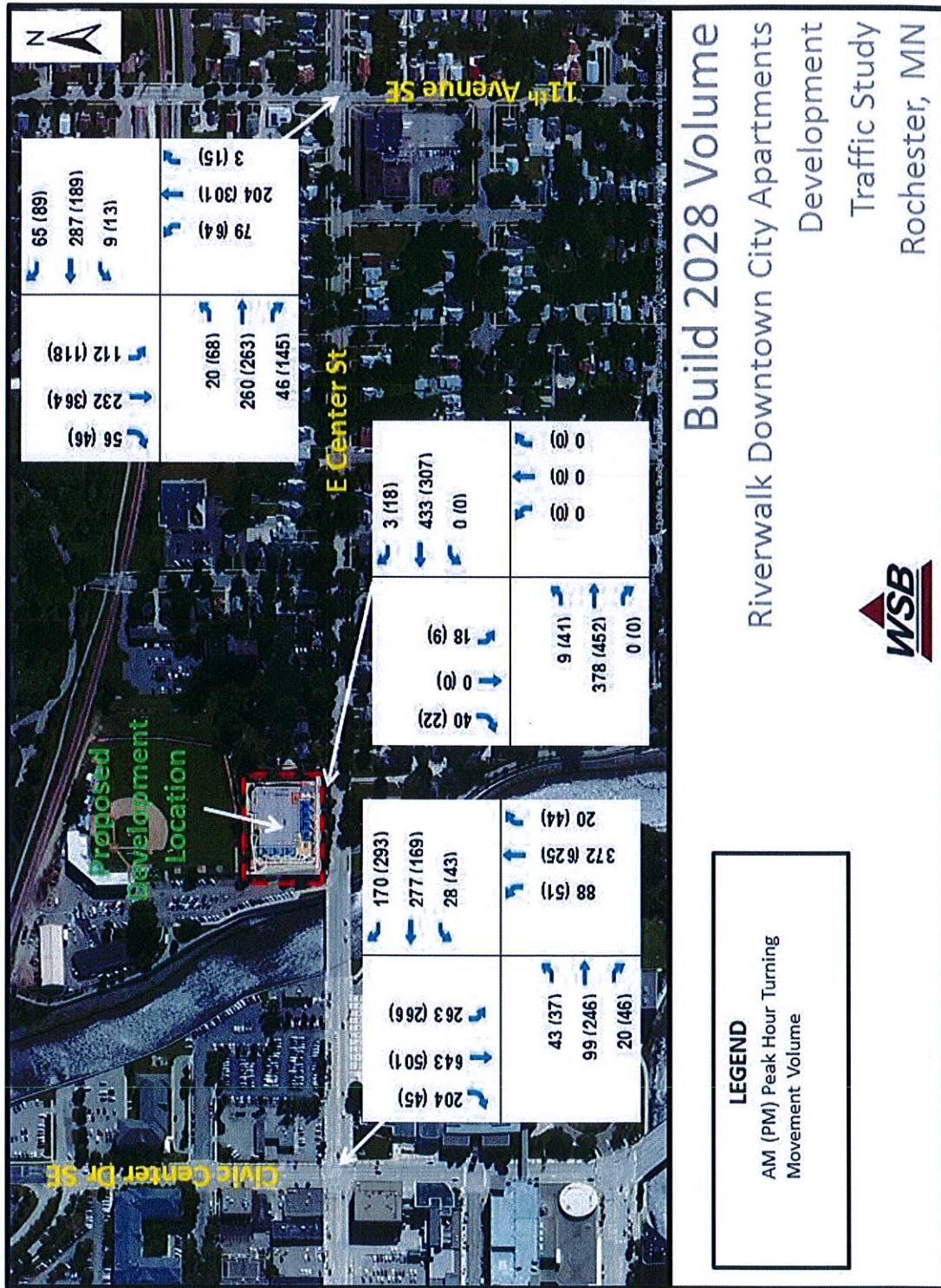
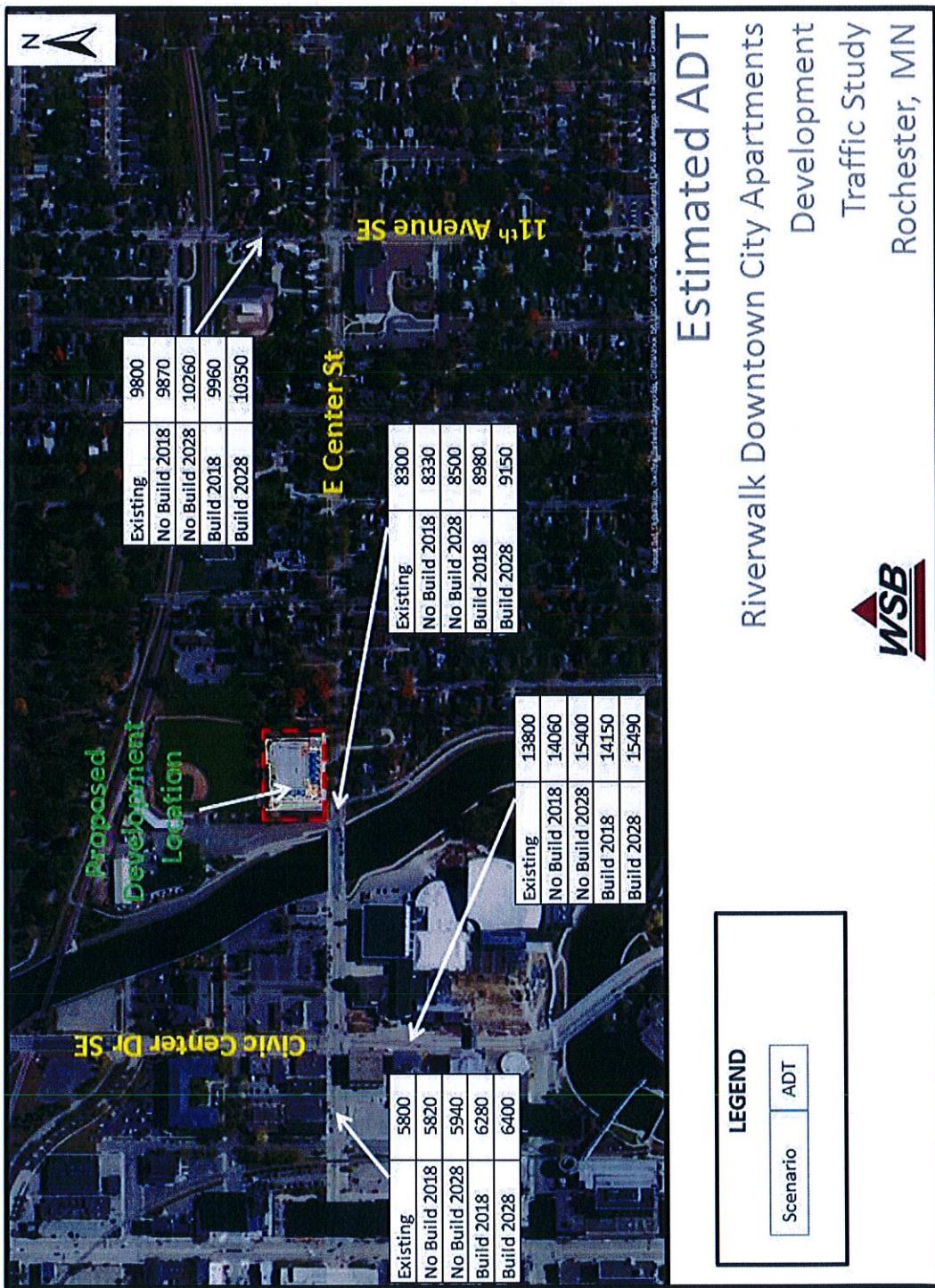


Figure 11: Average Daily Traffic (ADT) Projections



## OPERATIONS ANALYSIS

The intersection operational analysis process includes determining the LOS for the key intersections under the various peak hour traffic conditions. Using the forecasted traffic volumes, Synchro/SimTraffic models were developed for each scenario and Level of Service and other Measures of Effectiveness (MOEs) were calculated. Further explanation of Synchro/SimTraffic model and Level of Service can be found in Appendix A. The City of Rochester requires that Level of Service C or better shall be maintained on any arterial or higher order street and a Level of Service D or better on any other non-residential street. Individual movements within any intersection shall be maintained at or above a Level of Service E. The operational analysis evaluated the performance of the intersections under the following scenarios.

- No-Build conditions 2018
- Build Conditions 2018
- No-Build conditions 2028
- Build Conditions 2028

### NO-BUILD CONDITIONS 2018

Table 4 and Table 5 below display the AM peak hour and PM peak hour intersection Level of Service and queuing results under No-Build 2018 conditions. As can be seen from the tables, there is no significant change in the AM peak hour from existing conditions, and the delays stay at an acceptable level while through movement queues continue to exceed storage lengths of turn lanes similar to existing conditions.

### BUILD CONDITIONS 2018

In the Build scenario in 2018, the development is assumed to be in place with an access to the site from East Center Street, with one lane in and one lane out and stop control for the outbound driveway traffic. No turning lanes are assumed to be provided on East Center Street at the apartment driveway. Table 6 and Table 7 below display the AM peak hour and PM peak hour intersection Level of Service and queuing results under Build conditions in 2018.

As can be seen from the tables, the 2018 Build Scenario operates similar to the 2018 No-Build scenario with acceptable delays at all intersections. The new intersection of East Center Street and the apartment driveway also operates at excellent LOS A. There is occasionally some queueing in the eastbound direction at this intersection when left turning vehicles that seek to enter the driveway wait for gaps in the opposing westbound traffic and the eastbound through vehicles have to slow down or stop behind a left turning vehicle. Based on the anticipated left turn volumes and mainline volumes on East Center Street, a review of literature was conducted to determine the need for a left turning lane. *NCHRP Report 745 - Left-Turn Accommodations at Unsignalized Intersections* suggests a left turn lane may be beneficial based on the traffic levels. Details of this report are provided in Appendix C. However, a turn lane at this location would be inconsistent with the design of the rest of the corridor where turn lanes are only provided at major signalized intersections at Civic Center Drive SE and 11<sup>th</sup> Avenue SE.

## **NO-BUILD CONDITIONS 2028**

Table 8 and Table 9 display the AM peak hour and PM peak hour intersection Level of Service and queuing results in 2028 under No-Build conditions with no changes to the network and green time reallocation with new traffic volumes.

As can be seen from the tables, the delays stay at an acceptable level while through movement queues continue to exceed storage lengths of turn lanes similar to existing conditions.

## **BUILD CONDITIONS 2028**

The 2028 build conditions were analyzed by adding the estimated development traffic to the 2028 No-Build traffic volumes. Table 10 and Table 11 display the AM peak hour and PM peak hour intersection Level of Service and queuing results.

The results are similar to the 2028 No-Build Conditions. All of the intersections are expected to operate at acceptable levels of service in the 2028 Build conditions, although with the queueing issues that are seen in prior scenarios.

**Table 4: No-Build 2018 AM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement				LOS by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Appr	Average & Maximum Traffic Queueing (feet)			
				L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Right-Turn		Ave Queue	Max Queue	Max Storage	
1: Civic Center Drive & Center Street	NB	16	17	9	B	B	A	17	B					NB	38	90	400	97	179					
	WB	21	24	10	C	C	B	19	B	16	B	16	B	WB	11	44	125	100	215					
	SB	14	14	12	B	B	B	14	B					SB	78	173	400	115	224					
	EB	26	26	11	C	C	B	24	C					EB	32	93	150	59	127					
	NB	14	9	8	B	A	A	10	B					NB	34	96	100	52	137					
	WB	42	28	20	D	C	C	27	C	18	B			WB	10	69	100	152	276					
2: 11th Avenue & Center Street	SB	12	10	6	B	B	A	10	B					SB	38	90	300	72	182					
	EB	50	23	21	D	C	C	24	C					EB	14	65	150	124	255					

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 5: No-Build 2018 PM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement				LOS by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Appr	Average & Maximum Traffic Queueing (feet)			
				L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Right-Turn		Ave Queue	Max Queue	Max Storage	
1: Civic Center Drive & Center Street	NB	14	20	13	B	C	B	19	B					NB	25	58	400	149	248					
	WB	26	28	11	C	C	B	18	B	18	B	18	B	WB	28	79	125	85	163					
	SB	17	11	7	B	B	A	13	B					SB	79	182	400	75	167					
	EB	29	32	20	C	C	C	30	C					EB	28	80	150	135	254					
	NB	19	11	10	B	B	B	12	B					NB	29	73	100	85	204					
	WB	38	25	15	D	C	B	22	C	18	B			WB	13	48	100	109	235					
2: 11th Avenue & Center Street	SB	18	13	8	B	B	A	14	B					SB	50	115	300	116	234					
	EB	33	25	21	C	C	C	25	C					EB	45	182	150	148	324					

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 6: Build 2018 AM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Average & Maximum Traffic Queueing (feet)												Left-Turn				Through					
				Total Delay by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Left-Turn				Through					
				L	T	R	Delay	L	T	R	Delay	LOS	Delay	LOS	Delay	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	
1: Civic Center Drive & Center Street	Signalized	NB	18	19	12	B	19	B	18	C	18	B	17	B	17	NB	45	114	400	98	185				
		WB	18	24	8	B	C	A	18	B	B	B	15	B		WB	15	48	125	122	376	48	199	125	
		SB	16	16	13	B	B	B	15	B	C	B	23	C		SB	81	165	400	124	230				
	2: 11th Avenue & Center Street	EB	26	23	14	C	C	B	23	C	C	B	9	A		EB	31	82	150	57	138				
		NB	13	8	5	B	A	A	9	A	D	C	29	C	18	B	NB	32	74	100	49	122			
		WB	38	30	22	D	C	C	29	C	C	B	18	B		WB	14	102	100	160	284				
3: Center Street & Apartment Driveway	Signalized	SB	15	10	7	B	B	A	11	B	D	C	23	C		SB	43	117	300	75	170				
		EB	39	22	19	D	C	B	23	C	C	B	0	A		EB	16	52	150	128	258				
		NB	0	0	0	A	A	A	0	A	A	A	4	A	3	NB									
	Thru-Stop	WB	0	4	6	A	A	A	4	A	WB	WB	6	A	6	WB	8	29	63						
		SB	8	0	5	A	A	A	6	A	SB	SB	2	A	2	SB	5	5	5	60					
		EB	5	2	0	A	A	A	2	A	EB	EB				EB									

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 7: Build 2018 PM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement								LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Ave Queue				Max Queue			
				L		T		R		L	T	R	Delay	LOS	Delay	LOS	Appr	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	
				NB	14	21	13	B	C	B	20	C					NB	25	57	400	149	241					
1: Civic Center Drive & Center Street	Signalized	EB	NB	26	26	9	C	C	A	16	B	18	B				WB	30	82	125	89	212					
			WB	17	12	8	B	B	A	13	B					SB	81	181	400	80	159						
			NB	28	33	24	C	C	C	31	C					EB	29	116	150	148	278						
			WB	41	23	16	D	C	B	22	C					NB	37	149	100	105	230						
			SB	19	12	9	B	B	A	13	B					WB	13	74	100	108	261						
	Thru-Stop	EB	NB	35	25	19	D	C	B	25	C					SB	54	139	300	115	225						
			WB	0	0	0	A	A	A	0	A					EB	50	217	150	146	378						
			NB	0	3	2	A	A	A	3	A					NB											
			WB	12	0	4	B	A	A	6	A					SB	21	42									
			EB	5	3	0	A	A	A	3	A					EB			17	107							

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 8: No-Build 2028 AM Peak Hour Measures of Effectiveness**

Control	Intersection Location	Appr	Total Delay by Movement						LOS by Approach (Sec/Veh)			LOS by Intersection (Sec/Veh)			Appr	Average & Maximum Traffic Queueing (feet)					
			L	T	R	L	T	R	Delay	LOS	Delay	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Right-Turn Storage Queue				
1: Civic Center Drive & Center Street	NB	19	17	8	B	B	A	17	B			NB	42	87	400	99	181				
	WB	30	35	12	C	D	B	26	C	18	B	WB	15	120	125	127	276	66			
	SB	14	15	12	B	B	B	14	B			SB	79	185	400	128	234	125			
	EB	28	25	15	C	C	B	25	C			EB	30	69	150	58	135				
	NB	19	9	5	B	A	A	12	B			NB	43	97	100	55	142				
	WB	42	29	20	D	C	C	28	C	19	B	WB	8	77	100	162	305				
2: 11th Avenue & Center Street	SB	14	10	6	B	B	A	11	B			SB	43	121	300	82	176				
	EB	50	23	23	D	C	C	24	C			EB	15	92	150	135	258				

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 9: No-Build 2028 PM Peak Hour Measures of Effectiveness**

Control	Intersection Location	Appr	Total Delay by Movement						LOS by Approach (Sec/Veh)			LOS by Intersection (Sec/Veh)			Appr	Average & Maximum Traffic Queueing (feet)					
			L	T	R	L	T	R	Delay	LOS	Delay	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Right-Turn Storage Queue				
1: Civic Center Drive & Center Street	NB	13	21	14	B	C	B	20	C			NB	27	74	400	157	247				
	WB	23	29	13	C	C	B	19	B	19	B	WB	27	74	125	83	184				
	SB	18	12	9	B	B	A	14	B			SB	91	188	400	86	177	125			
	EB	28	32	24	C	C	C	30	C			EB	27	107	150	130	259				
	NB	21	11	10	C	B	B	13	B			NB	33	103	100	97	206				
	WB	39	24	16	D	C	B	22	C	18	B	WB	11	38	100	110	228				
2: 11th Avenue & Center Street	SB	20	12	8	C	B	A	14	B			SB	60	150	300	114	237				
	EB	34	24	21	C	C	C	24	C			EB	46	205	150	151	342				

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 10: Build 2028 AM Peak Hour Measures of Effectiveness**

Location	Intersection	Appr	Average & Maximum Traffic Queueing (feet)												Left-Turn			Through		
			Total Delay by Movement				LOS by Approach (Sec/Veh)				LOS by Intersection (Sec/Veh)				Left-Turn			Through		
			L	T	R	Delay	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Storage Queue	
Control Signalized	1: Civic Center Drive & Center Street	NB	18	20	10	B	C	B	19	B				NB	43	94	400	113	205	
		WB	21	22	7	C	C	A	17	B	17	B		WB	20	138	125	117	274	
		SB	16	17	14	B	B	B	16	B				SB	92	184	400	136	248	
		EB	30	24	14	C	C	B	24	C				EB	34	95	150	62	137	
		NB	17	11	6	B	B	A	13	B				NB	39	104	100	67	155	
		WB	38	27	19	D	C	B	26	C	18	B		WB	12	110	100	160	338	
Signalized	2: 11th Avenue & Center Street	SB	15	10	8	B	B	A	11	B				SB	44	108	300	78	170	
		EB	39	21	15	D	C	B	21	C				EB	17	44	150	134	296	
		NB	0	0	0	A	A	A	0	A				NB						
		WB	0	4	2	A	A	A	4	A				WB					4	
		SB	9	0	6	A	A	A	7	A	3	A		SB	29	79				
		EB	6	2	0	A	A	A	2	A				EB			8	83		
Thru-Stop	3: Center Street & Apartment Driveway	NB	0	0	0	A	A	A	0	A				NB						
		WB	0	0	0	A	A	A	0	A				WB						
		SB	9	0	6	A	A	A	7	A	3	A		SB	29	79				
		EB	6	2	0	A	A	A	2	A				EB			8	83		

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

**Table 11: Build 2028 PM Peak Hour Measures of Effectiveness**

Control	Intersection	Location	Appr	Total Delay by Movement								LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		Left-Turn Appr		Average & Maximum Traffic Queueing (feet)			
				L	T	R	L	T	R	Delay	LOS	Delay	LOS	Ave Queue	Max Queue	Storage Queue	Ave Queue	Max Queue	Through	Right-Turn	
				NB	13	23	15	B	C	B	22	C	20	C	NB	28	70	400	163	264	
1: Civic Center Drive & Center Street	SB	Signalized	NB	26	27	11	C	C	B	18	B	20	C	WB	29	86	125	98	220	91	209
			WB	18	12	8	B	B	A	14	B			SB	92	183	400	87	176		
			EB	25	33	21	C	C	C	30	C			EB	31	179	150	154	323		
	WB	Signalized	NB	25	13	10	C	B	B	15	B			NB	42	124	100	104	240		
			WB	50	24	16	D	C	B	23	C			WB	12	87	100	115	241		
			EB	19	12	10	B	B	B	13	B			SB	55	132	300	119	251		
2: 11th Avenue & Center Street	SB	Signalized	NB	32	25	18	C	C	B	24	C			EB	47	188	150	152	402		
			WB	19	12	10	B	B	B	13	B			NB							
			EB	0	0	0	A	A	A	0	A										
	EB	Thru-Stop	NB	0	3	3	A	A	A	3	A	3	A	WB							
			WB	10	0	4	B	A	A	6	A			SB	20	48					
			EB	5	3	0	A	A	A	3	A			EB				16	103		

Note: Turn lane queue lengths reported from SimTraffic are not valid when through movement queue exceeds turn lane length for the same approach

## SUMMARY

- An apartment development project is being proposed to open in 2017 north of East Center Street in Rochester, MN between Civic Center Drive SE and 11<sup>th</sup> Avenue SE.
- The proposed development will have 149 apartment units in a six story building with underground parking.
- Trips generated by the new development were estimated using ITE Trip Generation Manual 9<sup>th</sup> Edition. It was assumed that 10% of the trips generated by the apartment use will use other modes such as walking or transit. The development is estimated to generate approximately 924 daily trips with 69 trips in the AM peak hour and 90 trips in the PM peak hour.
- The proposed project will demolish existing low density housing in the parcel on which the development is proposed.
- A review of pedestrian facilities and transit availability was conducted as part of this analysis.
- Traffic growth rates were determined using the regional travel demand model and discussions with Olmsted County planning division.
- The analysis evaluated existing conditions, one year after opening (2018) and horizon year (2028).
- The study determined the impact of the proposed development on the local roadway network, and specifically, the following intersections in the vicinity of the proposed development:
  - Civic Center Drive SE and East Center Street
  - 11<sup>th</sup> Avenue SE and East Center Street
  - The apartment driveway and East Center Street
- In existing conditions, all intersections operate at a very good Level of Service. The maximum through movement queues on East Center Street exceed the storage lengths of the turning lanes at the intersections in almost all cases in existing conditions. At the 11th Avenue SE and East Center Street intersection, the maximum through movement queue in northbound direction exceeds the left turn storage in both peak periods.
- In all future scenarios, i.e. 2018 and 2028 No-Build and Build conditions, the study intersections continue to operate at an acceptable Level of Service. The through movement queue issues seen in existing conditions continue into future scenarios. However, the delays for turning vehicles at the approaches where the through queues exceed storage lengths are still low, indicating that significant mitigations may not be needed for this condition.
- In the Build Scenarios the new intersection of East Center Street and the apartment driveway operates at excellent LOS A. There is occasionally some queueing in the eastbound direction at this intersection when left turning vehicles that seek to enter the driveway wait for gaps in the opposing westbound traffic and the eastbound through vehicles have to slow down or stop behind a left turning vehicle. *NCHRP report 745 - Left-Turn Accommodations at Unsignalized Intersections* suggests a left turn lane may be beneficial based on the traffic levels. However, a turn lane at this location would be inconsistent with the design of the rest of the corridor where turn lanes are only provided at major signalized intersections at Civic Center Drive SE and 11th Avenue SE.

## APPENDIX A

### **ANALYSIS PROCESS**

The following provides further explanation of the models used in the study and LOS criteria.

#### **Analysis Tool**

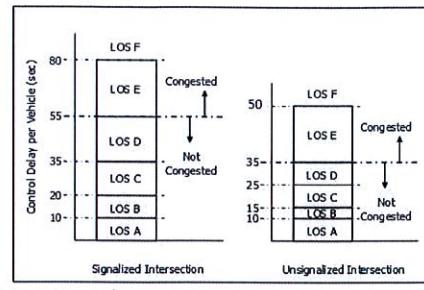
Synchro/SimTraffic analysis software was used to analyze the existing and forecast traffic volumes. Synchro 9.1 is a traffic operations analysis software package that implements the methodologies of the Highway Capacity Manual (HCM). Data from Synchro9 is transferred to SimTraffic 9.1, a detailed microscopic model that considers vehicle driver behavior, detailed interaction of vehicles with each other and the roadway between adjacent intersections, random behavior of drivers, and the delay for individual vehicles throughout the peak hour. Synchro 9.1 uses the HCM methodology to analyze intersection operations through one cycle of a traffic signal while SimTraffic 9.1 simulates the operation of the network of traffic signals through multiple cycles over a specified period of time (e.g., 60 minutes). All analysis results are from SimTraffic 9.1 and are based on the average of five SimTraffic 9.1 model runs for each peak hour and scenario.

#### **Intersection Level of Service**

The ability of an intersection to process traffic is affected by the number and type of vehicles, desired turning movements, intersection geometrics, and traffic control devices. Intersection Level of Service (LOS) differs from segment LOS in that the quality of traffic operations is defined as the delay to vehicles caused by the intersection's traffic control rather than the ratio of vehicle volumes to roadway capacity. Intersection LOS typically focuses on operations during the periods of the day with the highest traffic volumes, whereas segment LOS is based on traffic volumes over an average 24-hour period. Thus, the intersection LOS analysis gives a "worst-case" result for each intersection and more clearly identifies operational problems at the intersections.

The intersection operational analysis process includes determining the LOS for the key intersections under the existing peak hour traffic conditions. The City of Rochester requires that Level of Service C or better shall be maintained on any arterial or higher order street and a Level of Service D or better on any other non-residential street. Individual movements within any intersection shall be maintained at or above a Level of Service E. Figure below presents the intersection LOS thresholds, in terms of seconds of vehicle delay, as defined in the HCM.

#### **Intersection Level of Service Thresholds**



SOURCE: Highway Capacity Manual, 2010.

DRAFT

APPENDIX B  
Traffic Counts

DRAFT

Station Name:  
 Site ID:Center St  
 Station Num:W of 6th  
 Description:  
 City:Rochester  
 County:  
 Start Date/Time:18-Sep-16 00:00  
 End Date/Time:24-Sep-16 23:59

	18- Sun	19- Mon	20- Tue	21- Wed	22- Thu	23- Fri	24- Sat	Total	Daily- Avg.
00:00	Lane 1 (S)				40	40		80	40
	Lane 2 (N)				29	25		54	27
01:00	Lane 1 (S)				26	28		54	27
	Lane 2 (N)				18	13		31	16
02:00	Lane 1 (S)				14	19		33	17
	Lane 2 (N)				6	12		18	9
03:00	Lane 1 (S)				13	11		24	12
	Lane 2 (N)				8	16		24	12
04:00	Lane 1 (S)				11	11		22	11
	Lane 2 (N)				34	48		82	41
05:00	Lane 1 (S)				43	46		89	45
	Lane 2 (N)				104	103		207	104
06:00	Lane 1 (S)				137	121		258	129
	Lane 2 (N)				320	280		600	300
07:00	Lane 1 (S)				308	277		585	293
	Lane 2 (N)				426	402		828	414
08:00	Lane 1 (S)				229	238		467	234
	Lane 2 (N)				293	309		602	301
09:00	Lane 1 (S)				229	194		423	212
	Lane 2 (N)				191	214		405	203
10:00	Lane 1 (S)				186	202		388	194
	Lane 2 (N)				199	214		413	207
11:00	Lane 1 (S)				209	199		408	204
	Lane 2 (N)				253	259		512	256
12:00	Lane 1 (S)				287	278		565	283
	Lane 2 (N)				266	290		556	278
13:00	Lane 1 (S)			122	233			355	178
	Lane 2 (N)			139	289			428	214
14:00	Lane 1 (S)			273	274			547	274
	Lane 2 (N)			296	288			584	292
15:00	Lane 1 (S)			393	393			786	393
	Lane 2 (N)			343	334			677	339
16:00	Lane 1 (S)			437	427			864	432
	Lane 2 (N)			373	349			722	361
17:00	Lane 1 (S)			446	476			922	461
	Lane 2 (N)			262	282			544	272
18:00	Lane 1 (S)			250	255			505	253
	Lane 2 (N)			208	252			460	230
19:00	Lane 1 (S)			205	203			408	204
	Lane 2 (N)			162	184			346	173
20:00	Lane 1 (S)			163	190			353	177
	Lane 2 (N)			136	107			243	122
21:00	Lane 1 (S)			130	147			277	139
	Lane 2 (N)			99	85			184	92
22:00	Lane 1 (S)			94	103			197	99
	Lane 2 (N)			67	75			142	71
23:00	Lane 1 (S)			69	66			135	68
	Lane 2 (N)			54	35			89	45
Total				4721	8926	3849		17496	8748
Percentages				26.98%	51.02%	22.00%		100.00%	50.00%

**WSB & Associates**  
**701 Xenia Ave S**  
**Minneapolis, MN**

Center St & 11th Ave  
6-9am & 3-6pm  
Rochester, MN  
60's

File Name : Center St & 11th Ave  
Site Code : 2  
Start Date : 9/22/2016  
Page No : 1

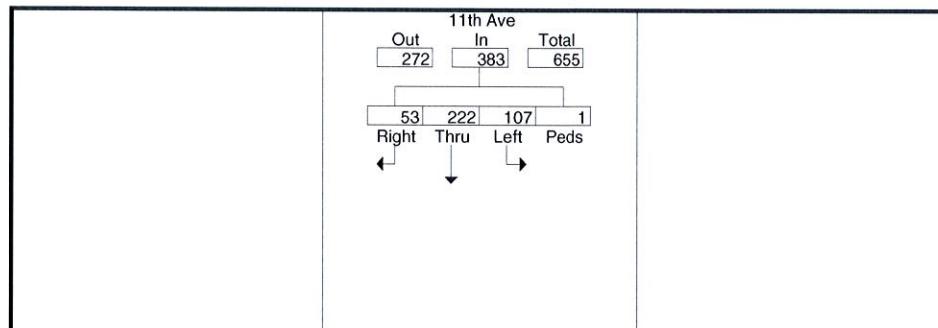
Start Time	Groups Printed- Cars +																				
	11th Ave From North					Center St From East					11th Ave From South					Center St From West					
Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total	
06:00 AM	5	4	5	0	14	7	41	0	0	48	0	10	9	0	19	3	9	0	1	13	94
06:15 AM	12	24	10	0	46	5	29	0	0	34	1	22	11	1	35	4	27	1	1	33	148
06:30 AM	19	26	5	1	51	5	71	0	1	77	0	15	20	1	36	5	23	2	0	30	194
06:45 AM	11	38	25	0	74	14	56	2	1	73	1	30	15	1	47	5	44	5	0	54	248
Total	47	92	45	1	185	31	197	2	2	232	2	77	55	3	137	17	103	8	2	130	684
07:00 AM	10	37	12	0	59	17	59	0	0	76	0	31	15	2	48	6	35	1	1	43	226
07:15 AM	12	56	27	0	95	18	76	4	1	99	0	49	18	0	67	9	57	4	0	70	331
07:30 AM	15	58	22	0	95	10	79	1	0	90	1	49	20	0	70	16	75	5	0	96	351
07:45 AM	16	71	46	1	134	18	65	4	0	87	2	66	22	0	90	8	81	4	0	93	404
Total	53	222	107	1	383	63	279	9	1	352	3	195	75	2	275	39	248	14	1	302	1312
08:00 AM	7	39	21	0	67	12	34	2	0	48	0	32	16	0	48	6	43	3	0	52	215
08:15 AM	11	37	20	0	68	14	40	0	0	54	1	27	15	0	43	11	41	5	0	57	222
08:30 AM	7	68	12	0	87	7	35	2	0	44	1	39	19	0	59	10	40	3	0	53	243
08:45 AM	16	53	20	0	89	13	20	1	0	34	1	44	17	0	62	9	37	5	0	51	236
Total	41	197	73	0	311	46	129	5	0	180	3	142	67	0	212	36	161	16	0	213	916
09:00 AM	0	3	2	0	5	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	7
Total	0	3	2	0	5	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	7
03:00 PM	8	52	23	0	83	10	40	2	0	52	1	44	16	2	63	16	44	13	0	73	271
03:15 PM	3	63	20	0	86	24	54	3	0	81	3	55	12	0	70	26	69	14	3	112	349
03:30 PM	12	59	13	0	84	17	57	5	4	83	3	66	19	2	90	42	68	9	5	124	381
03:45 PM	10	63	21	1	95	27	55	2	0	84	3	85	20	0	108	22	55	12	2	91	378
Total	33	237	77	1	348	78	206	12	4	300	10	250	67	4	331	106	236	48	10	400	1379
04:00 PM	11	63	14	0	88	38	61	3	1	103	1	57	13	2	73	33	72	16	5	126	390
04:15 PM	7	66	25	0	98	27	33	2	2	64	3	67	24	0	94	33	59	9	2	103	359
04:30 PM	8	40	15	4	67	26	58	1	0	85	1	53	21	0	75	22	51	7	2	82	309
04:45 PM	9	100	35	0	144	23	50	0	0	73	1	71	19	0	91	27	61	16	0	104	412
Total	35	269	89	4	397	114	202	6	3	325	6	248	77	2	333	115	243	48	9	415	1470
05:00 PM	12	81	26	1	120	31	47	3	0	81	1	73	15	4	93	29	61	16	1	107	401
05:15 PM	7	87	31	3	128	20	37	2	0	59	5	82	10	2	99	52	73	18	2	145	431
05:30 PM	10	80	21	0	111	13	45	8	2	68	7	62	11	5	85	31	59	13	2	105	369
05:45 PM	5	53	18	0	76	14	31	4	1	50	3	52	9	3	67	29	56	10	1	96	289
Total	34	301	96	4	435	78	160	17	3	258	16	269	45	14	344	141	249	57	6	453	1490
Grand Total	243	1321	489	11	2064	412	1173	51	13	1649	40	1181	386	25	1632	454	1240	191	28	1913	7258
Apprch %	11.8	64	23.7	0.5		25	71.1	3.1	0.8		2.5	72.4	23.7	1.5		23.7	64.8	10	1.5		
Total %	3.3	18.2	6.7	0.2	28.4	5.7	16.2	0.7	0.2	22.7	0.6	16.3	5.3	0.3	22.5	6.3	17.1	2.6	0.4	26.4	

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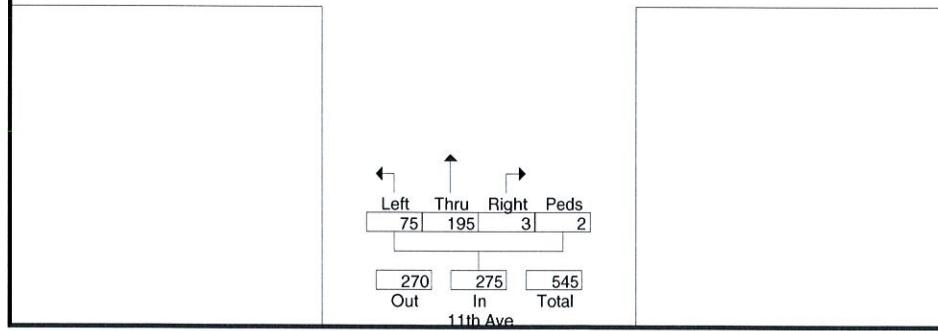
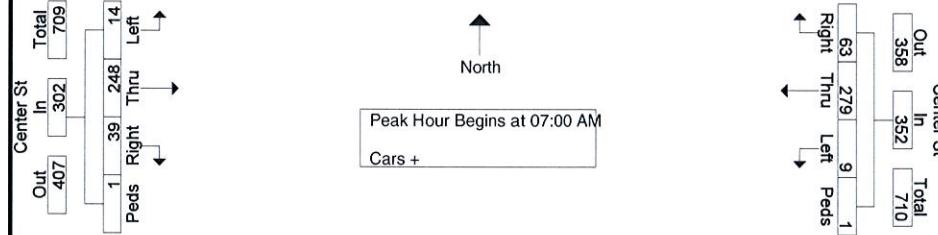
Center St & 11th Ave  
6-9am & 3-6pm  
Rochester, MN  
60's

File Name : Center St & 11th Ave  
Site Code : 2  
Start Date : 9/22/2016  
Page No : 2

Start Time	11th Ave From North					Center St From East					11th Ave From South					Center St From West					
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	10	37	12	0	59	17	59	0	0	76	0	31	15	2	48	6	35	1	1	43	226
07:15 AM	12	56	27	0	95	18	76	4	1	99	0	49	18	0	67	9	57	4	0	70	331
07:30 AM	15	58	22	0	95	10	79	1	0	90	1	49	20	0	70	16	75	5	0	96	351
07:45 AM	16	71	46	1	134	18	65	4	0	87	2	66	22	0	90	8	81	4	0	93	404
Total Volume % App. Total	53	222	107	1	383	63	279	9	1	352	3	195	75	2	275	39	248	14	1	302	1312
PHF	.828	.782	.582	.250	.715	.875	.883	.563	.250	.889	.375	.739	.852	.250	.764	.609	.765	.700	.250	.786	.812



Peak Hour Data

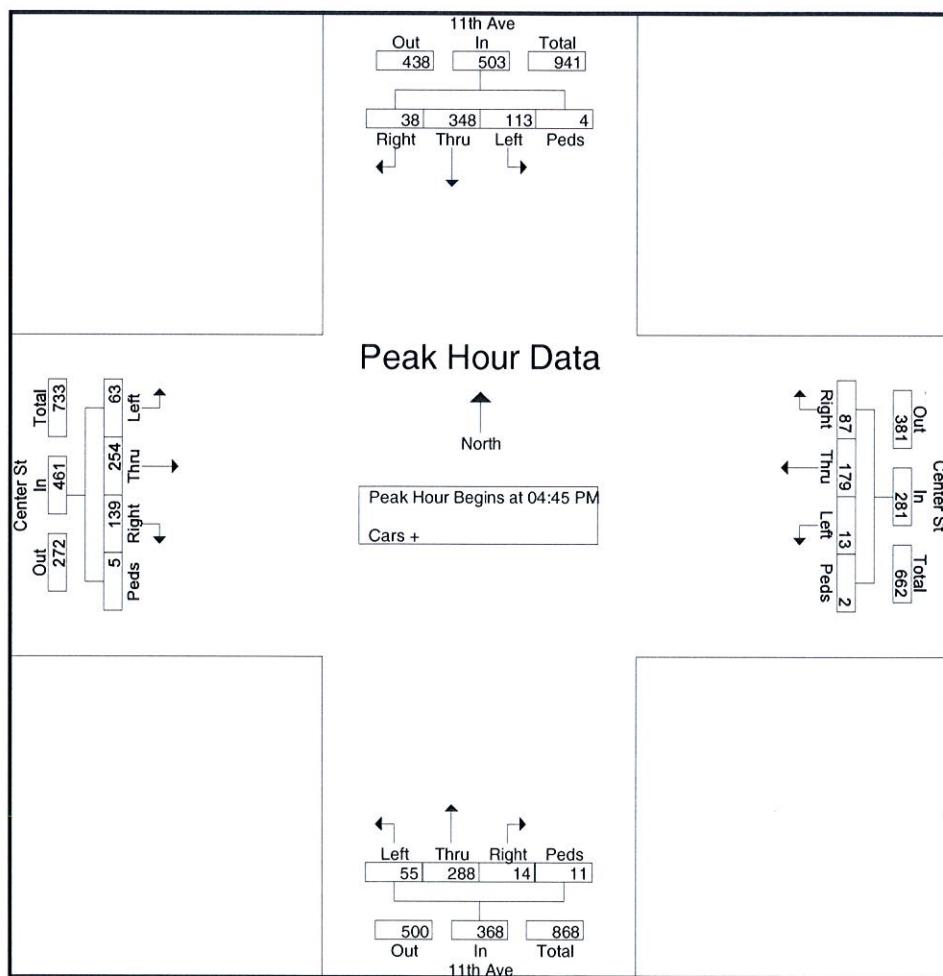


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**701 Xenia Ave S**  
**Minneapolis, MN**

Center St & 11th Ave  
6-9am & 3-6pm  
Rochester, MN  
60's

File Name : Center St & 11th Ave  
Site Code : 2  
Start Date : 9/22/2016  
Page No : 3

Start Time	11th Ave From North					Center St From East					11th Ave From South					Center St From West					
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	9	100	35	0	144	23	50	0	0	73	1	71	19	0	91	27	61	16	0	104	412
05:00 PM	12	81	26	1	120	31	47	3	0	81	1	73	15	4	93	29	61	16	1	107	401
05:15 PM	7	87	31	3	128	20	37	2	0	59	5	82	10	2	99	52	73	18	2	145	431
05:30 PM	10	80	21	0	111	13	45	8	2	68	7	62	11	5	85	31	59	13	2	105	369
Total Volume % App. Total	38	348	113	4	503	87	179	13	2	281	14	288	55	11	368	139	254	63	5	461	1613
PHF	.792	.870	.807	.333	.873	.702	.895	.406	.250	.867	.500	.878	.724	.550	.929	.668	.870	.875	.625	.795	.936



**WSB & Associates**  
**701 Xenia Ave S**  
**Minneapolis, MN**

Civic Center Dr & Center St  
6-9am & 3-6pm  
Rochester, MN  
60's

File Name : Civic Center Dr & Center St  
Site Code : 2  
Start Date : 9/22/2016  
Page No : 1

Groups Printed- Cars +

Start Time	Civic Center Dr From North					Center St From East					Civic Center Dr From South					Center St From West					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
06:00 AM	17	53	19	4	93	17	27	2	5	51	3	35	6	9	53	1	8	2	3	14	211
06:15 AM	23	68	24	6	121	22	33	3	6	64	4	41	10	11	66	2	10	3	3	18	269
06:30 AM	20	78	38	7	143	20	31	3	8	62	0	50	11	10	71	3	13	4	3	23	299
06:45 AM	35	90	33	5	163	24	35	4	1	64	3	40	15	10	68	3	16	9	1	29	324
Total	95	289	114	22	520	83	126	12	20	241	10	166	42	40	258	9	47	18	10	84	1103
07:00 AM	32	101	37	8	178	33	51	4	9	97	5	68	11	18	102	2	16	3	6	27	404
07:15 AM	44	131	47	11	233	43	63	5	11	122	7	79	19	21	126	4	19	6	6	35	516
07:30 AM	39	150	74	13	276	38	60	5	15	118	0	97	21	20	138	5	25	8	5	43	575
07:45 AM	68	174	64	10	316	47	68	8	2	125	5	77	29	20	131	5	31	18	1	55	627
Total	183	556	222	42	1003	161	242	22	37	462	17	321	80	79	497	16	91	35	18	160	2122
08:00 AM	32	121	50	9	212	32	52	3	1	88	5	80	10	10	105	6	15	10	5	36	441
08:15 AM	27	126	57	2	212	38	39	3	1	81	5	68	18	9	100	10	16	12	1	39	432
08:30 AM	22	98	44	2	166	36	25	6	1	68	1	73	12	5	91	6	14	12	1	33	358
08:45 AM	30	133	36	2	201	40	35	8	2	85	9	88	17	9	123	9	16	14	4	43	452
Total	111	478	187	15	791	146	151	20	5	322	20	309	57	33	419	31	61	48	11	151	1683
03:00 PM	11	92	39	23	165	73	23	10	6	112	4	108	10	6	128	13	37	7	3	60	465
03:15 PM	5	102	58	7	172	48	19	15	29	111	4	100	10	11	125	20	30	12	2	64	472
03:30 PM	11	112	52	19	194	64	31	13	2	110	7	132	15	15	169	9	39	3	2	53	526
03:45 PM	13	115	58	14	200	78	34	11	2	125	9	138	11	5	163	16	52	11	1	80	568
Total	40	421	207	63	731	263	107	49	39	458	24	478	46	37	585	58	158	33	8	257	2031
04:00 PM	8	98	64	0	170	76	45	4	2	127	7	148	12	7	174	12	47	8	1	68	539
04:15 PM	8	124	59	8	199	65	39	11	10	125	11	142	8	7	168	8	74	14	1	97	589
04:30 PM	6	94	52	11	163	61	42	4	0	107	9	128	16	5	158	13	52	10	2	77	505
04:45 PM	5	105	59	14	183	54	47	11	0	112	10	128	22	11	171	13	45	15	6	79	545
Total	27	421	234	33	715	256	173	30	12	471	37	546	58	30	671	46	218	47	10	321	2178
05:00 PM	5	59	27	8	99	27	17	4	9	57	4	76	7	9	96	13	33	7	6	59	311
05:15 PM	14	114	69	29	226	51	36	7	10	104	12	145	11	18	186	19	80	22	0	121	637
05:30 PM	8	123	71	5	207	63	30	8	6	107	14	110	12	9	145	19	46	11	1	77	536
05:45 PM	7	87	54	5	153	32	18	5	2	57	2	72	13	3	90	16	54	12	3	85	385
Total	34	383	221	47	685	173	101	24	27	325	32	403	43	39	517	67	213	52	10	342	1869
Grand Total	490	2548	1185	222	4445	1082	900	157	140	2279	140	2223	326	258	2947	227	788	233	67	1315	10986
Apprch %	11	57.3	26.7	5		47.5	39.5	6.9	6.1		4.8	75.4	11.1	8.8		17.3	59.9	17.7	5.1		
Total %	4.5	23.2	10.8	2	40.5	9.8	8.2	1.4	1.3	20.7	1.3	20.2	3	2.3	26.8	2.1	7.2	2.1	0.6	12	

APPENDIX C  
NCHRP 745 – Supporting Information on Left-Turn Lane Accommodation

National Cooperative Highway Research Program (NCHRP) is administered by the Transportation Research Board (TRB) and sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA). Individual projects are conducted by contractors with oversight provided by volunteer panels of expert stakeholders. NCHRP creates Reports, Syntheses of Practice, Research Results Digests, Web-Only Documents, and Legal Research Digests which contain the findings of individual research projects managed by TRB's Cooperative Research Programs. Reports are the main product of the research project and are often written as guidebooks or manuals. (Source: <http://www.trb.org/NCHRP/NCHRP.aspx>)

The NCHRP Report 745 titled “Left-Turn Accommodations at Unsignalized Intersections” provides the following table for determination of whether a left-turn lane would be warranted at unsignalized intersections. As can be seen from this table, with more than 40 lefts in the peak hour, a left turn lane is warranted when the arterial volume exceeds 150 vehicles per lane per hour.

**Table 3. Recommended left-turn lane warrants for urban and suburban arterials.**

Left-Turn Lane Peak-Hour Volume (veh/hr)	Three-Leg Intersection, Major Urban and Suburban Arterial Volume (veh/hr/ln) That Warrants a Left-Turn Lane	Four-Leg Intersection, Major Urban and Suburban Arterial Volume (veh/hr/ln) That Warrants a Left-Turn Lane
5	450	50
10	300	50
15	250	50
20	200	50
25	200	50
30	150	50
35	150	50
40	150	50
45	150	< 50
50 or More	100	< 50

The supporting information for NCHRP 745 provides the following discussion which refers to the same table.

**“MINIMUM VOLUME/ENGINEERING JUDGMENT**

Minimum volume criteria are considered in different criteria recommended by researchers and used in some states. For example, NCHRP Report 348 criteria by Koepke and Levinson provide two methods for determining the need for left-turn lanes (15). The first method is shown in Figure 6; a left-turn lane is warranted if more than 30 vehicles are turning left for 30- to 35-mph roadways (25 vehicles for 40- to 45-mph roadways). However, Koepke and Levinson state that in most cases, left-turn lanes should be provided where there are more than 12 left turns per peak hour. The benefit-cost ratio identified scenarios for rural highways when a left-turn lane is justified with as few as 5 veh/hr turning left when turning across as few as 50 veh/hr/ln. The research team recommends that the values in Table 80 and Table 81 (*Table 3 above in this context*) be used rather than a minimum volume.”